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INSTITUTIONAL CHALLENGES FOR STORMWATER CAPTURE: THE LOS ANGELES COUNTY EXPERIENCE

Alf W. Brandt

Institutional barriers impede fundamental reform of the way California's coastal communities manage stormwater runoff. Too many governments with too many competing objectives make concerted efforts at reform difficult to achieve in stormwater management. The city of Los Angeles has a drinking water agency—the famed Department of Water and Power—and a separate agency for sewers and stormwater—the Bureau of Sanitation. The larger county of Los Angeles (LA County) has countless drinking water agencies and many of its eighty-eight cities manage their own stormwater drains. The county, however, serves as a unifying force in many communities' sewage treatment, flood control, and stormwater in the county's river systems—the Los Angeles and the San Gabriel.

Last year, the United States Supreme Court addressed this morass of agencies with responsibility for stormwater in *Los Angeles County Flood Control District v. Natural Resources Defense Council*, 568 U.S. ___ (2013). It held that the transfer of water between different concrete parts of the Los Angeles River (LA River), which the district managed, did not constitute a "discharge" of pollutants. The Court did not answer the question of when that discharge occurred, leaving open the possibility that each city may hold responsibility for its stormwater drains into the river. This diffusion of responsibility reflects one of the many institutional challenges for stormwater management in LA County.

Those institutional challenges are many: legal, financial, governmental, even cultural. These challenges have emerged out of Los Angeles' history of development and the evolving national legal and regulatory approaches to managing stormwater. Los Angeles developed when planners treated stormwater as a waste to be flushed downstream as quickly as possible. More recently, the "opportunity" of stormwater as a water supply has emerged as the region's imported water supplies have become more costly and less reliable.

I. The Institutional Challenges

Improving interagency coordination with the many public agencies that touch stormwater in LA County is just one of the many institutional challenges to expanding stormwater capture. Other challenges include issues arising out of water rights, land use, public health concerns, building standards, and the other great challenge—how to pay for stormwater capture projects.

Water Rights. Today, California has many kinds of water rights, not necessarily legally connected, even when there is a hydrological connection. Many may have some connection to stormwater capture—groundwater rights, surface riparian rights, surface

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appropriative rights, storage rights, contract rights (for imported water), and Los Angeles "pueblo rights" (origin in Spanish/Mexican law).

For stormwater capture, the water right issue arises out of who has rights to rainwater and stormwater, whether on private property, in stormwater pipes, or stormwater channels, man-made or natural. While the city's "pueblo rights" may give it the right to stormwater in the LA River, those rights do not apply to the rest of the county. In 2012, AB 1750 (Solorio) codified a State Water Resources Control Board (SWRCB) statement on capturing rainwater off a roof: The landowner does not need to obtain a water right to capture that rainwater. That statute left open the question of whether a water right is required for water in stormwater systems before it reaches a natural channel. Water Code Section 1201 requires a water right to divert water from a "natural channel." Cities with stormwater systems therefore could argue that they do not need a water right to capture stormwater before it touches the natural channel. Downstream water right holders could assert—and have asserted—that their water right includes water running off city streets and downstream to their point of diversion. The legislature has not resolved that issue, but it has come up in discussion this year in the context of a stormwater finance bill, AB 2403 (Rendon), whose author has suggested the possibility of giving water rights to cities operating storm drains.

Land Use and Development. LA County's existing development pattern has shaped how the region manages its stormwater and will continue to present a challenge to stormwater capture. Before settlement, much of the rain falling on LA County infiltrated into the groundwater aquifers connected to the Los Angeles and San Gabriel Rivers. The land was open and allowed infiltration. After World War II, housing and development boomed, making county land impervious to groundwater infiltration. That development included a massive system of storm drains, with the LA County managing the stormwater system.

While much of the county remains impervious, recent studies have shown that some open space may be available for stormwater infiltration. At a recent State Assembly hearing in LA County on a proposed water bond, one witness presented the "Green Solution Project" that had analyzed public open space lands throughout LA County. That study showed that 268 projects could be developed on existing public lands (e.g., schools) to capture 4,000 acre feet of rainwater each year. http://awpw.assembly.ca.gov/sites/awpw.assembly.ca.gov/files/Community%20Conservation%20Solutions_GreenSolutions_WaterBond_3-14-14.pdf

Building Standards. In recent years, building standards for rainwater capture has drawn the attention of the California Legislature and state agencies. The governor's 2012 signing of the Rainwater Capture Act followed three years of spirited debate over building standards for rainwater capture. The bill included only a statement of water rights and nothing about building standards in order to prevent interference with the California Building Standards Commission's adoption of CalGREEN 2013, a green building code that includes building standards for capture and nonpotable use of rainwater. *See* www.hcd.ca.gov/codes/shl/CALGreen_Guide_REV_12-13.pdf.

Water Quality Regulation. Last year's Supreme Court decision in *LA County* clarified that the county is not responsible for water quality as a "discharge" from one part of the LA River to another. It did not address who has responsibility for stormwater discharges or whether exceedances at river monitoring stations constituted a violation of the stormwater permit. The court remanded to the Ninth Circuit, which concluded that the exceedances constituted a violation of the permit. (The Supreme Court denied *certiorari*.). The conflict over compliance with the Regional Water Quality Control Board's (Regional Board) stormwater permit for the LA River therefore continues.

Nevertheless, regardless of how that conflict proceeds, stormwater capture will be a part of the county's compliance strategy. The Regional Board's regulatory strategy for stormwater includes "low-impact development" (LID) and "green infrastructure" for

stormwater and rainwater capture. *See* www.swrcb.ca.gov/losangeles/water_issues/programs/stormwater/municipal/lid_and_greenst/index.shtml.

Finance. The diffusion of responsibility among stormwater, water supply, and flood control agencies adds to the challenge of stormwater finance. As stormwater capture projects develop, funding may be limited, in part because responsibility and authority for capturing the water is divided. The agency with responsibility for only one part of the project (either water supply or stormwater management) has no incentive to pay for the whole project. Funding therefore depends on interagency collaboration, which may not be easy.

Furthermore, the cities that manage storm drains usually rely on their property tax base to pay for stormwater, at least for maintenance of the drain system. Since California voters approved Proposition 13 in 1978, availability of property tax revenues has been limited. As a result, cities have increasingly relied on support from the state for their operations. State funding has been limited though, especially in recent years as the State General Fund dwindled during the recession. Stormwater funding therefore may depend on a state general obligation bond that includes allocations for stormwater. The legislature currently is discussing replacement bond measures that include funding for stormwater.

A California constitutional provision, Article XIIID, also challenges the authority of local agencies to raise revenues for stormwater. In order to raise taxes or fees, the local government must obtain voter approval. Article XIIID allows a simpler process for water and sewer charges, allowing rate increases subject only to a majority-protest process. A 2002 appellate court decision, however, did not allow a stormwater charge to qualify as either water or sewer, requiring a vote of the people to charge for stormwater management. *See Howard Jarvis Taxpayers Association v. City of Salinas* (2002) 98 Cal.App.4th 1351. A 2013 decision allowed a program that included stormwater capture to use the less onerous majority-protest process because the stormwater capture program increased groundwater supplies. *See Griffith v. Pajaro Valley Water Management Agency,* (Oct. 15, 2013) ___ Cal.App.4th ___. This year, Assembly Bill 2403 (Rendon) proposes to codify the *Griffith* decision.

II. The Opportunities

Despite the institutional challenges, LA County has made significant progress on advancing stormwater capture. A multitude of factors has contributed to this progress. Stormwater regulation required cities to reduce pollutant loads, often with expensive treatment facilities. Reaction to regulation and the costs of compliance led to creating methods to reduce stormwater flows, especially in new developments. Permits for construction required builders to control runoff from their property while under construction, and MS4 permits required retention of stormwater on-site. When required to retain stormwater, builders developed new methods for retaining the water—often called "low-impact development" or LID. The question remains, however, what to do with that water.

Reduced reliability and increased cost of imported water has also affected the perspective on the potential of stormwater as a water supply. This reduced reliability of imported water has led many Southern California water agencies to increase investments in local water supply options, especially groundwater that can be recharged with stormwater.

Coastal Basin Opportunity. The nature of the Southern California coastal plain provides a unique opportunity for capturing stormwater. Its rivers are relatively short and manageable. Its groundwater aquifers have space for additional storage—more than 2 million acre-feet. Because Southern Californians are surrounded by mountains and ringed by beaches they can more easily identify with their watershed and connect to its resources.

Stormwater Supply Studies. In order to exploit the stormwater opportunity, agencies have conducted studies to help assess the potential for stormwater as a supply. The Council for Watershed Health (Council), which advocates for a "fully integrated flood protection/water conservation system," began a study

of the potential for stormwater as water supply in 2000. The Council published conclusions from its Water Augmentation Study (study) in 2010 and continues to manage water monitoring programs throughout the watershed. The study found that while surface water storage may be limited, the basin's groundwater aquifers have substantial unused capacity. Increased stormwater capture could add an additional 384,000 acre-feet of water to aquifers annually. The study also found no apparent trends to indicate that stormwater infiltration, over the long-term, will negatively affect groundwater quality.

Stormwater Infrastructure Projects. Infrastructure projects in stormwater capture also have demonstrated the potential for water supply. The Council coordinated development of a model stormwater capture project on Elmer Avenue in the San Fernando Valley, where a neighborhood was transformed by redesigning hard surfaces, landscaping, and drainage facilities to capture and use stormwater, instead of stormwater flooding the streets on its way to the LA River. The City of Los Angeles Bureau of Sanitation has been working on stormwater projects throughout the city. The Bureau's more significant projects include:

- Riverdale Green Street - Elysian Valley community (NE Los Angeles)
- Garvanza Park Rainwater Capture Project - Highland Park (NE Los Angeles)
- South Los Angeles Wetlands Park - South Central
- Westside Park Rainwater Irrigation Project - Mid-City
- Penmar Park Rainwater Capture Project - West Los Angeles

Tujunga Wash. The county of Los Angeles has also played an instrumental role in developing the "Tujunga Watershed Project" to capture and store stormwater in groundwater aquifers. Since 2005, communities in the eastern San Fernando Valley have collaborated to take advantage of what they describe as "our strongest regional opportunity to secure a sustainable local water supply while enriching native habitat and improving quality of life for residents." The legislature has appropriated some bond funds in support of this project, but much of the financing has come from local sources. *See* www.theriverproject.org/tujungawash/index.html.

Los Angeles River. While much of the twentieth-century work on the LA River applied the "flood control" approach of moving water downstream quickly, some agencies have used spreading grounds for decades to infiltrate stormwater and replenish groundwater aquifers. The Water Replenishment District, which replenishes the Central and Westside Groundwater Basins in southern LA County, offers the best example. It has set a goal of eliminating its need for imported water for replenishment, instead relying on stormwater and recycled water. The city of Los Angeles is currently implementing a plan to revitalize the river, including removal of some concrete where water might infiltrate to aquifers. The city's Department of Water and Power also has adopted a 2010 Urban Water Management Plan with targets for expanding stormwater capture to infiltrate the San Fernando Valley aquifer. *See* www.lariver.org/index.htm.

Rainwater Capture. In addition to the large agency stormwater projects, individual landowners can make a difference, capturing rainwater off their roofs before it enters a stream or stormwater drain. While existing law remains ambiguous as to whether rainwater capture requires a water right, homeowners all across Southern California have begun installing some form of rainwater capture system. The Southern California economy benefits from thriving businesses that design, manufacture, and install rainwater capture systems. When the city of Los Angeles offered rain barrels to homeowners, the response was overwhelming and the city quickly ran out. The program was 400 percent oversubscribed. *See* www.lastormwater.org.

Stormwater and Recycled Water. State and local agencies have recognized a connection between recycled water and stormwater. Both water sources are part of the same water system and cycle. Treated water may be discharged to waterways during storms, recycled for later use, or captured for replenishing groundwater. In 2009, when the SWRCB developed its "Recycled Water Policy," it included goals for using more stormwater for water supply. It set a 2020 goal of 500,000 acre-feet of stormwater use and a 2030

goal of 1 million acre-feet. *See* www.waterboards.ca.gov.

III. Conclusion

The institutional challenges to stormwater capture in LA County may be many, but the opportunities are just as plentiful. The region's unique conditions—reliance on expensive, less reliable imported water, groundwater aquifer storage capacity, and limited local water supplies—may help local agencies collaborate in expanding stormwater capture as a key component of the region's water supply portfolio.

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EPA SETS BACK TWO MAJOR INITIATIVES TO IMPROVE URBAN STORMWATER MANAGEMENT

Brian G. Glass

In his poem "The Waste Land," T. S. Eliot famously wrote that "April is the cruellest month." For a number of environmental organizations seeking to improve urban stormwater management, "the cruellest month" arrived ahead of schedule this year. In March, the U.S. Environmental Protection Agency (EPA) dealt serious blows to two major initiatives aimed at reducing pollution caused by stormwater runoff from the built environment. First, EPA declined to grant a trio of petitions filed by several environmental organizations demanding that the agency regulate runoff from certain existing developments in impaired watersheds. Then, EPA deferred indefinitely its long-awaited national stormwater rulemaking that the agency committed to advance as part of a settlement agreement with another environmental organization. Both decisions offer clues about how the agency intends to regulate urban stormwater runoff in the future.

Background

When land is converted from forest or agricultural uses to urban or suburban landscapes, soil and vegetation that have the ability to retain water are covered or replaced with hard surfaces, resulting in increased stormwater runoff. As it travels over the land, this runoff can pick up pollutants and deliver them to surrounding waterbodies. It can also increase the volume and velocity of flowing waters, resulting in increased sediment pollution as well as the loss of aquatic habitat and other stream functions.

Urban stormwater runoff is one of the leading sources of impairment of our nation's waterbodies. It has also proven to be one of the most intractable to regulate. In 1987, in an effort to address the problem, Congress added section 402(p) to the Clean Water Act (CWA), requiring EPA to regulate, among other stormwater discharges, those from certain municipal separate storm sewer systems (MS4s), the conveyances that collect stormwater from developed areas and

discharge it into waters of the United States. Under section 402(p), permits for these discharges are required to impose "controls to reduce the discharge of pollutants to the maximum extent practicable."

To implement section 402(p), EPA developed regulations in two phases: the Phase I rule, finalized in 1990, which applies to MS4s serving populations of 100,000 or more (the "medium" and "large" MS4s); and the Phase II rule, finalized in 1999, which applies to other MS4s located in an "urbanized area" as defined by the Bureau of the Census (the "small" MS4s). The two rules bear certain similarities (e.g., all regulated MS4s are required to develop a stormwater management program). They also contain some notable differences (e.g., only medium and large MS4s are required to implement a program to control stormwater discharges from industrial facilities).

Unfortunately, the two rules have been less successful in reducing the pollutants caused by urban stormwater runoff than one might have hoped. Indeed, since the time that Congress added section 402(p), the list of waterbodies impaired by this source of pollution has only continued to grow, prompting EPA in 2006 to ask the National Research Council (NRC) to conduct a review of its stormwater program. In 2008, the NRC released a report, which offered several recommendations for improvement.

Proposed National Stormwater Rulemaking

In December 2009, EPA issued a notice in the *Federal Register* announcing its plans to initiate a national rulemaking to strengthen its stormwater program. In its notice, EPA requested stakeholder input on several preliminary regulatory considerations, many of which derived from the NRC's recommendations. First, noting that urbanized areas comprise only 2 percent of the total land area in the United States, EPA solicited comments on whether and how to expand the area subject to federal stormwater regulations. Next, observing that small, medium, and large MS4s are all confronting virtually identical issues, EPA requested input on whether it should develop a consistent set of requirements that would apply equally to all regulated MS4s. EPA also solicited views on whether it should include additional requirements to further reduce stormwater impacts in sensitive areas like the Chesapeake Bay.

Far more controversial than these considerations, however, were two others that EPA floated. First, EPA invited comments on establishing more specific requirements to control stormwater discharges from new development and redevelopment. Although the Phase I and Phase II rules both require regulated MS4s to address these discharges in their stormwater management programs, neither set of regulations mandates specific management practices or standards, which has resulted in a patchwork of different obligations across the country. In its notice, EPA appeared keenly interested in developing a uniform numeric national standard that would promote practices that retain stormwater on-site through infiltration, evapotransporation, and stormwater reuse, sometimes referred to as low-impact development or green infrastructure.

Second, EPA requested input on whether it should require MS4s to address stormwater discharges in areas of existing development through retrofitting of the sewer system, drainage area, or individual structures with improved stormwater control measures. Although in some states permits require MS4s to install retrofit practices to retain stormwater from existing areas of impervious cover, the regulations do not impose this obligation. In its notice, EPA requested comment on whether it should require MS4s to develop a long-term retrofit implementation plan to manage existing sources of urban stormwater runoff.

In general, it is more expensive to implement stormwater control measures in the built environment than it is in open areas with fewer site constraints. For that reason, a retrofit requirement had the potential to impose a significant financial burden on the municipalities that operate regulated MS4s. For similar reasons, a strict uniform retention standard had the potential to discourage redevelopment. There were also questions about whether it is even possible to develop a uniform national standard that can account for all of the variability in climate and soils that exists around the country. The proposals also raised

questions about how to ensure the long-term maintenance typically required of stormwater control measures.

In spite of all of these challenges, in May 2010, EPA committed itself to moving forward with a rulemaking when it entered into a settlement agreement with an environmental organization and others to resolve a lawsuit challenging the agency's response to pollution in the Chesapeake Bay. Among other things, the settlement agreement required EPA to issue a proposed rule by September 30, 2011, and to take final action on the rule by November 19, 2012. Although appearing strong out of the gate, the rulemaking seemed to stumble down the stretch, requiring EPA to obtain several extensions of its 2011 deadline to propose a rule, as well as to retreat from some of its more ambitious considerations, including its retrofit proposal.

Then, on March 19 of this year, EPA abruptly announced that it was deferring action on its national stormwater rulemaking indefinitely. According to its website, "EPA is updating its stormwater strategy to focus now on pursing a suite of immediate actions to help support communities in addressing their stormwater challenges." Because the settlement agreement committing EPA to a rulemaking severely restricted the remedies available for a breach, it seems unlikely that EPA will face any legal consequences for this decision.

Petitions to Exercise Residual Designation Authority

Shortly after EPA indicated that it would not be pursuing a retrofit component in its national stormwater rulemaking, several environmental organizations stepped up to try to fill that void, at least in part. Section 402(p) of the CWA and its implementing regulations authorize EPA and the states to designate any currently unregulated stormwater discharge, or category of discharges within a geographic area, for regulation and permit coverage upon determining that the stormwater discharge or category of discharges "contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States." This authority is often referred to as the agency's "residual designation authority," or "RDA."

The regulations also include a provision allowing any person to petition the permitting authority to exercise its residual designation authority. Invoking this provision, on July 10, 2013, several environmental organizations submitted petitions to three EPA regions (collectively, the "RDA petitions"). In the RDA petitions, the organizations demanded that EPA Regions 1, 3, and 9 determine that stormwater discharges from certain commercial, industrial, and institutional (CII) sites contribute to water quality standards violations and require permits.

First, the petitioners identified all of the waters within the subject regions that have been formally listed as impaired by one or more of several pollutants commonly associated with urban stormwater runoff (i.e., lead, zinc, copper, phosphorous, nitrogen, sediment, biological oxygen demand, and chemical oxygen demand). The petitioners then asserted, and cited scientific data to support, the general proposition that stormwater discharges from impervious surfaces on CII sites "consistently contain elevated levels of these pollutants." On that basis, the petitioners argued that EPA must designate for regulation and permit coverage "all non-*de minimis*, currently non-permitted stormwater discharges from [CII] sites" within the impaired watersheds identified.

Presently, MS4 operators are responsible for the stormwater runoff that enters their systems from existing private development. The RDA petitions invited EPA to shift some of that responsibility back onto some of the properties generating the runoff. On March 11–12, 2014, EPA largely declined these invitations.

In evaluating the petitions, the regions applied the same general criteria that EPA had used to designate additional categories of stormwater sources for regulation in the development of its Phase II rule. Applying those criteria, Regions 3 and 9 denied the petitions outright. Both regions concluded that there was insufficient data to directly connect the stormwater

from a particular CII source, or category of CII sources, to any specific water body impairments. Indeed, both regions were able to point to specific examples to illustrate how granting the petitions would have swept up a large number of properties that were *not* significant sources of water quality impairment. Both regions also identified a number of other federal, state, and local programs that in their view already sufficiently addressed stormwater discharges from CII sites.

Unlike its counterparts, Region 1 did not deny the petition. Nor did the region grant it. Instead, Region 1 committed to "evaluate individual watersheds where site-specific information may support a designation." Notably, all three regions indicated that they will continue to evaluate currently unregulated sources of stormwater runoff for potential designation. Because legal challenges to the responses would face a steep uphill battle, it seems unlikely that the petitioners will file any.

Conclusion

Based on the regions' responses to the RDA petitions, it seems reasonable to anticipate that residual designation will play a more prominent role in EPA's ongoing efforts to improve urban stormwater management, at least in Region 1, but possibly in other regions as well. The regions' responses also provide a roadmap for the filing of future RDA petitions. Look for environmental organizations to follow that roadmap in submitting new, more targeted RDA petitions that may be more difficult for the agency to deny.

As for the national stormwater rulemaking, on a webpage previously devoted to the subject, EPA now states that it "will provide incentives, technical assistance, and tools to communities to encourage them to implement strong stormwater programs; leverage existing requirements to strengthen municipal stormwater permits; and continue to promote green infrastructure as an integral part of stormwater management." In light of this statement, it seems reasonable to anticipate that EPA will try to achieve at least some of the goals of its deferred stormwater rulemaking through its existing permitting processes. Look for EPA to attempt to graft some of its preliminary regulatory considerations onto future MS4 permits, a number of which have already expired and are up for renewal.

Stakeholders should carefully monitor all of these activities, as there likely will be opportunities for public participation. Legal challenges of MS4 permits and future RDA petitions also seem inevitable. We certainly have not heard the final word on either of these initiatives. The national stormwater rulemaking and RDA petitions may be gone for now, but their presence likely will be felt for years to come.

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TRENDS IN STORMWATER REGULATIONS AND OPPORTUNITIES FOR GREEN BUILDING

Ty Asfaw

Stormwater is precipitation that flows over agricultural land, construction sites, and urban development, and, as a result, often carries pollutants into nearby water bodies. Traditional stormwater control practices had primarily aimed at quickly directing water away from developments and into nearby water bodies in order to avoid potential flooding. Due to the escalating impairment of these water bodies and concerns about future climate change impacts, the federal government, as well as state and local governments, have each increasingly focused on improving their stormwater policies.

To ensure progressive action is taken with respect to these water bodies, EPA has put in place regulatory and programmatic mechanisms to see that discharges are managed effectively. However, because of the sheer volume and episodic nature of stormwater discharges, problems continue to permeate the waterways. In 2009, EPA started gathering data to develop a rulemaking to control the long-term discharge of stormwater from developments. However, EPA recently announced that it will no longer develop a rule; it will instead provide technical assistance to strengthen communities' stormwater programs and encourage innovative local policies. *See* http://cfpub.epa.gov/npdes/stormwater/rulemaking.cfm.

EPA's effort emphasizes natural dispersion systems that use vegetation and infiltration devices, also known as Low Impact Development (LID) or green infrastructure. The basic concept behind green infrastructure and LID is to allow stormwater to filter back into the soil on-site by using rain gardens and bio-infiltration, rather than conveying discharge to stormwater ponds or off-site facilities. Federal, state, and local regulators are increasingly pursuing these LID and green infrastructure methods to manage and retain stormwater discharge runoff from new developments. For example, the federal government adopted stormwater runoff standards for federal buildings under the Energy Independence Security Act (EISA) of 2007. EISA requires newly developed and redeveloped federal projects with a footprint above 5,000 square feet to achieve predevelopment hydrology to the "maximum extent technically feasible" through the use of LID practices.

Impacts of Low-impact Development Programs on the Building Community

Currently, builders and developers must develop a Stormwater Pollution Prevention Plan (SWPPP) as part of their state's construction permit requirements under the CWA's section 402 National Pollutant Discharge Elimination System. A SWPPP shows how stormwater will be managed during the active phase of construction. Similarly, EPA's Phase I and II Municipal Separate Storm Sewer Systems (MS4) program sets minimum measures for both large cities and small communities to control stormwater runoff from construction sites during the active construction and postconstruction phases. *See* http://cfpub.epa.gov/npdes/stormwater/munic.cfm.

Builders and developers will heavily rely on their team of engineers and architects and the support from local regulators to successfully implement LID and green infrastructure practices. There are, however, several barriers to widespread adoption of such practices. Barriers could be site-specific physical limitations, while others are institutional, technical, social and economic factors. Cost is often one such barrier that is identified by builders. Increased costs associated with construction, operation, and maintenance can be highly variable and in some cases unknown. There are also the upfront costs of increased review and redesign often required prior to LID project approval. Additional barriers include homeowners' negative perception of such devices and concerns about long-term maintenance.

There is also apprehension about LID's ability to manage peak flow rates. Local officials, especially those in flood-prone areas, are concerned about the long-term performance of green infrastructure and potential liability. As a result, builders are being required to implement centralized ponds in addition to green infrastructure, which may use up available land and prove problematic for developers. A variety of LID features that will not encumber developable land is therefore key to encouraging implementation.

Also, some traditional local development requirements are at odds with LID because they result in more impervious areas, such as wider street requirements that ensure adequate room for fire trucks. To implement LID, many jurisdictions require builders to apply for variances or exemptions from existing city and county codes, which slows a project's plan-approval process—a significant disincentive to adopting LID practices. Accordingly, the EPA Smart Growth Office developed a Water Quality Scorecard to help municipalities remove barriers to green infrastructure. *See* www.epa.gov/dced/water_scorecard.htm. To encourage these better stormwater controls, local officials will need to make substantial changes to existing codes and ordinances.

Green Building Trends

Builders and developers have progressively shown an interest in energy conservation and environmentally friendly construction practices through their active participation in green building programs. According to research on Green Market Size by McGraw Hill Construction released in January 2014, there was increased participation in green building programs even during the economic downturn. Reinforcing this trend, the ICC 700 National Green Building Standard (*see* www.nahb.org/generic.aspx?genericContentID=194088) and other green building programs (*see* www.epa.gov/greenbuilding/standards/index.html) provide credit for erosion and sediment control, water conservation, limitation of site disturbance, and use of LID principles. Successful implementation of LID requires builders and developers to incorporate these practices during the early stages of the project; collaboration is necessary among all parties, including engineers, landscape architects, the public, and the government.

Effective implementation of LID also requires continued education of consumers, policy makers, builders, and contractors. For example, maintenance crews will need to think differently about mowing and clearing LID sites for aesthetic reasons because vegetation is critical for infiltration and evapotranspiration purposes. Moreover, homeowners and building owners must understand that LID facilities look and work differently than traditional stormwater management facilities.

Challenges and Opportunities for Communities with Combined Sewer Overflows

Nearly 772 communities have old combined sewer systems (CSS) that carry sanitary sewage and stormwater in combined pipes. When overloaded from rain or snow, these old systems release untreated sewage into lakes and rivers, an event known as a Combined Sewer Overflow (CSO). CSS are expensive to upgrade; nevertheless, because of the CWA, many communities are required to address their CSO problems in accordance with enforcement agreements. *See* www2.epa.gov/enforcement/national-enforcement-initiative-keeping-raw-sewage-and-contaminated-stormwater-out-our. Consequently, green infrastructure is becoming popular among several communities under these consent decrees. Big cities such as Chicago and Philadelphia have signed CWA settlement agreements with EPA that require the local governments to invest between $2.5 and $3 billion over the next decade to reduce CSO events. Rather than dig miles of deep tunnels for storing sewage and stormwater, cities are opting to invest in green infrastructure to cut costs of compliance.

Funding Future Green Infrastructure Projects

Sustainable funding for stormwater programs is critical. Like any stormwater management approach, LID requires routine inspections, maintenance, and repair or replacement to ensure that the devices are functioning properly. However, municipal stormwater programs currently do not have the funds necessary to adopt these green infrastructure practices. Management of LID devices therefore requires a more stable, long-term source of financing, such as stormwater utilities—separate organizational entities with the sole purpose of collecting stormwater fees—that run self-sustaining stormwater programs. Public support will be necessary to secure such a dedicated source of funding that, going forward, enables local governments to efficiently manage effective stormwater programs.

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USING PRIVATE INCENTIVES FOR THE PUBLIC BENEFIT

Nina Marinaro

The Problem

Many of America's earliest cities constructed combined sewer systems (CSS), which were once esteemed as innovative and progressive. According to EPA, CSS currently serve 772 communities and 40 million people across America. *See* http://cfpub.epa.gov/npdes/cso/demo.cfm. CSS have become outdated, expensive to maintain, and costly to our environment. However, the constraints of time, money, and existing infrastructure make the task of separating the sewer systems "out of the question" in many cities. We are left with the question of how to manage and regulate our stormwater in the most sustainable and cost-effective way.

A CSS is a system used to both capture stormwater and transport wastewater to a municipality's wastewater treatment plant (WWTP). Though stormwater is the central issue in combined sewer overflow (CSO) remediation, it is the presence of *raw sewage* in a water body that threatens a community; the stormwater merely creates the problem. During heavy rainfall, high volumes of stormwater can cause a WWTP to reach treatment capacity; the combination of stormwater and sanitary waste can then back up and flow into a nearby water body. The typical urban disproportion between green space and concrete, or permeable and impermeable areas, exponentially enhances the problems associated with stormwater runoff because a decrease in green space causes an increase in CSO discharges. *See* www.nrdc.org/water/stormwater/green-infrastructure-pa.asp. Concrete and "grey" infrastructure (CSS, pipes, tunnels, streets, parking lots, etc.) make up the majority of urban surface area, contributing to high volumes of stormwater.

EPA estimates the total annual cost of CSO maintenance nationwide is $56 billion. *See* http://erosioncontrol.biz/SW/articles/economical_CSO_management_14216.aspx. Luckily for municipalities and their utility ratepayers, there are alternatives cheaper than traditional "grey" infrastructure to manage our CSO volumes, including regulations and private incentives that promote green infrastructure.

The Solution

Philadelphia, PA

Philadelphia's twenty-five-year long-term control plan (LTCP), *Green City, Clean Waters*, commits to reduce the city's CSO discharge volume by 7.96 billion gallons per year. *See* www.nrdc.org/water/pollution/rooftopsii/files/RooftopstoRivers_Philadelphia.pdf. The *Green City, Clean Waters* LTCP involves the use of various green infrastructure, including green roofs, tree trenches, rain gardens, and permeable pavements, to name a few. It also adopts a "land-water-infrastructure" approach to adequately address the three main sources leading up to a CSO crisis: the "land" portion involves implementing green infrastructure to increase the permeable land surface area; the "water" program improves and maintains the ecological integrity of the water bodies receiving CSO discharges; and the "infrastructure" initiative involves typical "grey" projects. *See* http://phillyriverinfo.org/CSOLTCPU/CSOLTCP_Update/pdf/oow%20ltcp%20billstuffer.pdf.

Philadelphia has adopted new rules in conjunction with its LTCP, which require "on-site management of the first inch of rainfall in all new developmental projects with at least 15,000 square feet of earth disturbance." www.nrdc.org/water/pollution/rooftopsii/files/RooftopstoRivers_Philadelphia.pdf. The city also offers tax incentives to private property owners who utilize green infrastructure to manage rainfall runoff sites. *See* http://continuingeducation.construction.com/article.php?L=5&C=1151&P=2. This distinguishable combination of regulations and incentives will pave the way for a sustainable solution to the CSO issue in Philadelphia.

Ultimately, Philadelphia expects to spend only $1.67 billion on its LTCP through its use of a green and grey infrastructure approach compared to an estimated $10

billion to achieve the same CSO reduction using a grey-only approach. *See* www.nrdc.org/water/pollution/rooftopsii/files/RooftopstoRivers_Philadelphia.pdf.

Portland, OR

Portland, Oregon, has been deemed a national leader in using green infrastructure. *See* http://nrdc.org/water/pollution/rooftopsii/files/RooftopstoRivers_portland.pdf. However, more than half of Portland's surface area remains impervious—of this impervious area, roughly 25 percent is due to paved streets and 40 percent is due to rooftops (excluding the city's green "ecoroofs"). *See id.* To address this issue, Portland adopted a *Green Building Policy* as part of its LTCP, the *Grey to Green Initiative*, requiring all newly constructed facilities to incorporate green infrastructure, like green ecoroofs. *See id.* Ecoroofs are not only ecological, but also economical: residents may qualify for grants of up to $5 per square foot of ecoroof installed. *See id.*

To offset the costs associated with CSO remediation, Portland offers incentives to private land owners who implement green infrastructure. For instance, Portland "prefers" a project that uses "vegetated practices" and manages "right-of-way stormwater runoff both at the source and at the surface." Projects that do not incorporate these techniques are subject to management fees. *See id.*

Through a combination of infrastructure (including grey) and private incentives, Portland has reduced CSOs to one of its water bodies, the Columbia Slough, by 99 percent. www.portlandoregon.gov/bes/article/201850. Portland estimates its LTCP, using the green-grey approach, will require $81 million, whereas a "grey-only" approach would cost $144 million to yield the same CSO reductions. *See* www.erosioncontrol.biz/SW/articles/economical_CSO_management_14216.aspx.

Syracuse, NY

In 2009, Syracuse, New York, became the first city in the United States subject to a legal requirement, pursuant to a consent judgment issued to Onondaga County, New York, to reduce CSO events using green infrastructure. *See* www.nrdc.org/water/pollution/rooftopsii/files/RooftopstoRivers_Syracuse.pdf. Prior to the consent judgment, the region's CSS was capturing 74 percent of wet weather flow each year; after the consent judgment, the county became obligated to achieve a 95 percent capture rate. *See id.* To achieve its capture rate goal Syracuse must capture 250 million gallons of stormwater each year, costing an estimated 35 cents per gallon. *See id.* As part of the consent agreement, Syracuse was also forced to abandon construction of several new WWTPs in favor of implementing green infrastructure as part of its LTCP, called the *Save the Rain Campaign*. *See id.* So far, Onondaga County has invested over $80 million to its *Save the Rain Campaign*, funded mostly by sewer fees, low-interest loans, and grants the municipalities have received from New York State. *See id.*

The *Save the Rain Campaign* also includes stormwater ordinances. *See id.* However, Syracuse seems to have found a balance between creating rigid requirements and allowing room for industrial flexibility. The Syracuse Green Improvement Fund provides incentives to private property owners who implement green infrastructure thereby creating potential for industrial and economic growth despite legal requirements to use green infrastructure to reduce CSO volumes. The Fund allows engineers discretion over which type of green infrastructure to install, but grant sizes depend on the amount of stormwater the infrastructure will capture. *See id.*

New York, NY

In many respects, New York City (NYC) has been a willing frontrunner for progress in the state, country, and beyond. However, NYC is struggling to achieve the enviable CSO reductions Syracuse has realized. One major difference between the two New York cities, other than the obvious landscape variance, is that NYC has emphasized grey infrastructure. *See* http://nyc.gov/html/dep/pdf/green_infrastructure/CO2-20110512-25.pdf. As of 2011, the NYC Department of Environmental Protection (DEP) (which maintains the city's CSS) estimates that 72 percent of NYC's 305 square miles is impervious. www.nyc.gov/html/dep/html/stormwater/index.shtml.

To remedy this urban disproportion, NYC promulgated a green infrastructure plan in 2012, called *PlaNYC 2030*. *See* www.nyc.gov/html/dep/pdf/green_infrastructure/gi_annual_report_2013.pdf. *PlaNYC* calls for a citywide CSO reduction and applies stormwater control performance standards to public and private developers. *See id.* The initiative also funds stormwater management programs with grants to private individuals and entities: as of its 2012 Annual Report, the DEP has awarded $3.4 million through its Green Infrastructure Grant Program to private property owners who implement green infrastructure. *See id.*

Though NYC has already made green improvements to its landscape, it has not achieved CSO reductions as profound as Syracuse has. To date, the DEP has or will spend approximately $3.7 billion in grey infrastructure to reduce CSO volumes by 8.3 billion gallons per year: at a cost of $1 to $2 per gallon CSO reduced. *See* http://hpigreen.com/tag/combined-sewer-overflow/. In addition, the DEP plans to spend $750 million on projects that will increase water quality but will not yield any CSO reduction. *See* www.nyc.gov/html/dep/pdf/green_infrastructure/gi_annual_report_2013.pdf. However, the DEP estimates that it will receive $2.4 billion in public and private funding to implement green infrastructure and that NYC will obtain between $139 to $418 million in "triple bottom-line benefits" over the next twenty years, such as energy savings, increases in property value, and health improvements. http://hpigreen.com/tag/combined-sewer-overflow/.

Nevertheless, NYC could see more dollar signs saved if it creates more incentives and space for innovation. If there is any city that could create an industry to value rainwater, it would presumably be the hub of all finance: NYC.

The Future

Perhaps more cities should take a similar approach to that adopted by Syracuse. A city that identifies a desired end and takes an (almost) laissez-faire approach to the means allowed by industry will ensure maximum industrial, economic, and environmental progress.

If more incentives are offered to private property owners and developers to utilize land for green infrastructure projects, then municipalities and ratepayers would get more bang for their buck; municipalities would essentially outsource maintenance costs, one of the most costly aspects of our existing CSS, while ratepayers would receive some economic compensation while beautifying the neighborhood. Incentives would lead to an increase of on-site stormwater management and a decrease of runoff entering the CSS. This would result in a decrease of CSO events and a decrease of grey infrastructure used in stormwater management. Maintenance costs for green infrastructure are relatively cheap compared to those associated with grey infrastructure; furthermore, these costs are offset by the incentives provided; and, most importantly, people will begin to value something they always considered free, thus creating room for a new industry to boom: rainwater.

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